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Endemic flora of the Soutpansberg, Blouberg and Makgabeng

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ABSTRACT

A synopsis of the endemic vascular plants of three clearly defined geomorphic features namely the Soutpansberg, Blouberg and Makgabeng is provided. Biogeographically these three mountain ranges are unique comprising an interesting interchange of species amongst each other and the Central Southern African Mountainous Archipelago. The findings presented emanate from a continuously updated database (1986 onwards) of the endemic flora of the Soutpansberg, Blouberg and Makgabeng. Data was assimilated from field work and herbarium specimens as cited under voucher specimens and literature reviewed as listed under references. Forty-four endemic taxa are recorded for these three mountains belonging to 32 families and 32 genera. This wide range of families and genera also demonstrates that the endemic flora of these three mountain ranges is not resultant of a single group diversifying into a multitude of forms, but that the endemics evolved independently from several unrelated lineages.
The Soutpansberg, Blouberg and Makgabeng serve as essential biological refugia and it is critical that they be conserved.

1. Introduction

In the past, the delineation of the Soutpansberg endemic and near endemic flora has often been subjective, poorly defined and confusing, having no bearing on their biogeographic affinity (Hahn, 2006). The Soutpansberg Centre of Plant Endemism (CPE) as defined by Van Wyk and Smith (2001) includes both the Blouberg and the Soutpansberg Mountain ranges and this article expands the examination of the endemic plant taxa to the Makgabeng. Within the context of this article the Blouberg and Soutpansberg mountain ranges are treated as separate as they are clearly distinct biogeographically and geomorphologically and are further separated by 40 km of semi-arid savannah.

Hahn (2002) proposed that the Soutpansberg and Blouberg mountain ranges form part of a Central Southern African Mountainous Archipelago. Biogeographically the Soutpansberg, Blouberg and Makgabeng are unique with their flora comprised of an interesting interchange of species amongst each other and the Central Southern African Mountainous Archipelago (Hahn, 2006). Partridge et al. (2010) described the Soutpansberg Geomorphological Province (GP) encompassing the Soutpansberg, Blouberg and Makgabeng. In a subsequent revision of the Soutpansberg GP (sensu Partridge et al., 2010), Hahn (2011) showed that the three mountains are in fact three unique Geomorphological Provinces.

Hahn (2002) concentrated only on the Soutpansberg (sensu stricto) part of the Soutpansberg CPE and recorded 33 Soutpansberg CPE endemic vascular plant taxa comprising of 25 genera and 17 families. It is therefore clear that the endemic flora of the Soutpansberg has not arisen as a result of a single group diversifying into a multitude of forms. The Soutpansberg (sensu stricto) is also unique amongst South African centres of endemism in supporting the largest higher order diversity of vascular plants (Van Wyk and Smith, 2001) comprising 2693 taxa, 1023 genera and 239 families (Hahn, 2006).

The Soutpansberg habitat diversity is a direct result of its extremes of geomorphological complexity which create a multitude of succeeding micro-climates. The Soutpansberg, Blouberg and Makgabeng serve as essential biological refugia, a fact already realised by Leemann (1935), who mentioned that the Blouberg is of importance to our understanding of anthropogenic vegetation change.

2. Study area

2.1. Soutpansberg

From east to west, the Soutpansberg extends approximately 210 km and from north to south it is 60 km at its widest and 15 km at its narrowest, covering a surface area of 6700 km^2 (Fig. 1). It ranges in altitude from 200 m near Pafuri in the east, to Hanglip 1719 m (second highest peak) and Lejuma 1748 m (the highest peak) situated towards the west. Geologically the Soutpansberg represents a volcanic and sedimentary succession, with the underlying

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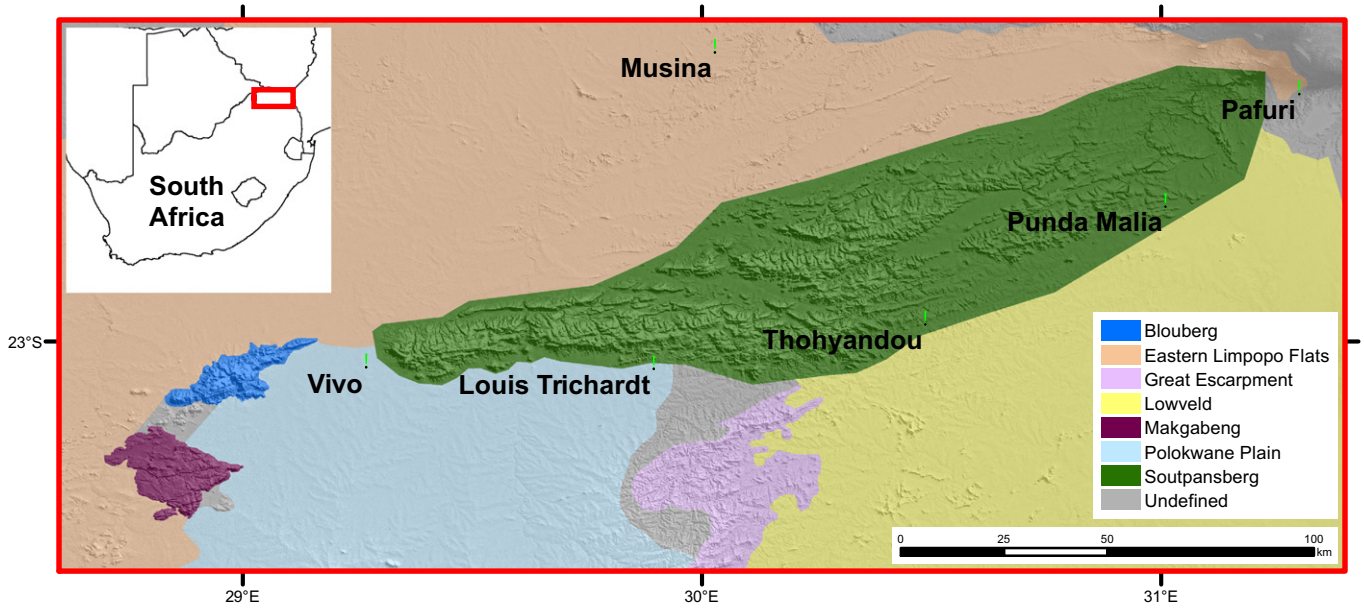

Fig. 1. Map showing the Soutpansberg, Blouberg and Makgabeng including the surrounding geomorphic provinces.

formations comprised of basalt overlain by quartzite (Barker et al., 2006). Geomorphologically the Soutpansberg is characterised by a succession of predominantly east–northeast trending homoclinal ridges (Hahn, 2011). The Soutpansberg group dips at approximately 15–35° to the north and rises abruptly in the south. The most prominent characteristic of the Soutpansberg is its southern slopes. In the west they form high cliffs becoming a steep rolling landscape along the central section with cliffs becoming dominant once again in the eastern extremity. The southern central regions of the Soutpansberg are also situated in the highest rainfall area with Entabeni receiving up to 1874 mm per annum (Hahn, 2006). The Soutpansberg's rainfall steadily diminishes from Entabeni eastwards with Punda Maria receiving 545 mm per annum. The rain shadow of the Great Escarpment causes Louis Trichardt's rainfall to drop to 618 mm per annum. The combined rain shadows of the Soutpansberg and Great Escarpment cause Waterpoort to have the lowest recorded rainfall of 367 mm per annum.

The Soutpansberg boasts an incredibly diverse interchange of habitats which can range from Afro-montane forest to semi-desert scrubland in a transect of less than 10 km. The Soutpansberg habitat can best be described as forming a continuous mosaic. The high rainfall grasslands of the Soutpansberg situated on clay soils derived from weathered basalt are extinct (Hahn, 2017). These high rainfall grasslands could have covered as much as 10% of the Soutpansberg. The loss of species diversity taxa as a result of the extinction of these grasslands can never be ascertained but could be substantial.

2.2. Blouberg

The Blouberg spans about 37 km from its south-western point to its most north-eastern point covering a surface area of approximately 223 km^2 (Fig. 1). In altitude the Blouberg rises from 840 m at its eastern extremity up to 2053 m at Blaauwberg peak which is situated approximately in the centre of this mountain. Even though the Blouberg Mountain shares the same geological setting as the Soutpansberg, geomorphologically it can best be described as an Inselberg rising abruptly from its surrounding plain. The Soutpansberg is separated from the Blouberg by a 40 km gap running across the Palala Shear Belt which forms the divide between the Limpopo Belt and the Kaapvaal Craton (Brandl, 2001). The Blouberg climate is strongly attitudinally bound both in temperature and orographic precipitation.

The foothills are characterised by scrub vegetation, while gallery woodlands and thickets traverse the main drainage lines. From an altitude of about 1500–1600 m on a southern to eastern aspect the remnants of *Afrocarpus falcatus*, (Thunb.) C.N. Page, forests are found. On reaching the upper plateau situated at an altitude of about 1600 m the vegetation becomes gramineous with wooded patches and bushland frequenting the drainage lines and this progresses upwards till the summit at 2053 m is reached.

2.3. Makgabeng

From east to west the Makgabeng extends over approximately 31 km, covering a surface area of approximately 332 km^2 (Fig. 1). In altitude the Makgabeng rises from 820 m in the west to 1411 m at the eastern extremity of the mountain. Seen from afar the Makgabeng orographic feature can best be described as a ruggedly eroded, gently westerly dipping cuesta with a prominent V-shaped scarp towards the east (Hahn, 2011). Physiographically the Makgabeng strata are characterised by a network of variously orientated dykes. In the east the range is well defined, but in the west it diminishes gradually into a series of low lying hills. Geologically the Makgabeng forms part of the Waterberg group sediments (Barker et al., 2006). The Makgabeng's eastern scarp occasionally receives mild mist. When compared to the other two mountain ranges, the Makgabeng displays the least climatic extremities.

The vegetation of the Makgabeng is characterised by savannah vegetation growing in the deeper sandy soils, with scrub confined to the rocky areas.

3. Methods

A continuously updated 30 year old database of the endemic flora of the Soutpansberg, Blouberg and Makgabeng was analysed. Data was assimilated from field work and herbarium specimens as cited under voucher specimens and literature reviewed as listed under references. The main field work on which this article hinges was carried out over the period from 1986 till 2010 and again commencing from 2016. Voucher specimens cited are those from the National Herbarium

Pretoria (PRE), Schweickerdt Herbarium, University of Pretoria (PRU) and Herbarium Soutpansbergensis (ZPB). The endemic species are divided into three categories according to their biogeographical affinity.

The first section of the results provides a synopsis of the endemic plant species of the Soutpansberg, Blouberg and Makgabeng restricted to the bounds of their respective Geomorphological Provinces (Hahn, 2011). This is followed by a synopsis of the first order near endemics referred to as *protoparaendemics* (Hahn, 2006). Soutpansberg–Blouberg protoparaendemics is the only class recognised within the study. The last section includes Soutpansberg–Blouberg–Makgabeng second order near endemics referred to as *biparaendemics*. The synopsis is concluded by a list of excluded species; these are either species previously thought to be endemic to the study area but now found further afield or newly described species that are considered synonymous with more widely distributed species.

4. Results (Fig. 2)

4.1. Soutpansberg endemics

4.1.1. Acanthaceae

4.1.1.1. Blepharis spinipes. K. Vollesen in *Blepharis* (Acanthaceae) a taxonomic revision: 130 (2000). Type: South Africa, Limpopo, 2229 (Waterpoort): Vancollers Pass, on the rocky slopes in the poort (–DC), 900 m, 25 Jun 1990, *Balkwill 5888* (K, holo.; J, iso.!).

Distribution and habitat: *B. spinipes* is only known from the northern slopes of the far western Soutpansberg growing in exposed rocky areas and in fissures within bedrock.

Related taxa: *B. spinipes* is possibly related to *Blepharis ilicina* Oberm. from the Eastern Cape (Vollesen, 2000).

Fig. 2. 1 *Huernia nouhuysii*, 2 *Ipomoea bisavium*, 3 *Vangueria soutpansbergensis*, 4 *Aloe angelica*, 5 *Aloe hahnii*, 6 *Aloe petrophila*, 7 *Aloe vossii*, 8 *Aloe vogtsii*, 9 *Combretum vendae* var. *glabrata*, 10 *Delosperma* zoutpansbergense, 11 *Duvalia procumbens*, 12 *Justicia montis-salinarum*, 13 *Kalanchoe crundallii*, 14 *Stapelia clavicorona*, 15 *Rhynchosia vendae*, 16 *Zoutpansbergia caerulea*, 17 *Encephalartos hirsutus*, 18 *Mystacidium braybonae* & 19 *Senegalia montis-salinarum*.

Voucher: 2229 (Waterpoort): Bluebell (–CD), *Hahn 1797* (K, ZPB); Vancollers Pass (–DC), *Balkwill 5888* (K, J).

4.1.2. Aizoaceae

4.1.2.1. Delosperma zoutpansbergense. L. Bolus in The Journal of South African Botany 25: 372 (1959). Type: South Africa, Limpopo, 2229 (Waterpoort): summit of Clouds End, above Mountain Inn [New Gate] (–DD), 31 Dec 1958, (cultivated, flowered Apr 1959), *Mogg* NBG2/59 (BOL, holo.!; NBG!, iso.!).

Distribution and habitat: *D. zoutpansbergense* a polymorphic species found primarily within the southern wet mist belt region of the Soutpansberg where it grows amongst vegetation or in humus-rich pockets, rarely in the open.

Related taxa: This genus needs revision as many unresolved taxonomic problems exist. *D. zoutpansbergense* falls within a multifarious complex of related taxa mainly occurring to the south of the Soutpansberg. Possibly synonymous with *Delosperma mahonii* (N.E. Br.) N.E. Br. said to occur on both the Wolkberg and Eastern Highlands of Zimbabwe (Hahn, 2002).

Voucher: 2229 (Waterpoort): Hanglip (–DD), *Hahn 645* (ZPB), LaRoch (–DD), *Hahn 605* (PRE, ZPB), New Gate (–DD), *Hahn 635* (ZPB), *Mogg NBG2/59* (BOL, NBG), Zwarthoek (–DD), *Hahn 593* (ZPB).

4.1.2.2. Khadia borealis. L. Bolus in Notes on the *Mesembryanthemum* and allied Genera 3: 6 (1936). Type: South Africa, Limpopo, 2229 (Waterpoort): on the farm Ventersdorp on the summit of the Zoutpansberg, *Crundall BOL21638* (BOL, lecto.!).

Distribution and habitat: *K. borealis* favours a drier habitat than *D. zoutpansbergense*, growing in shallow soil pockets on flat rock strata sheets within the mist belt. *K. borealis* has been found growing along the central Soutpansberg at an altitude of above 1250 m.

Related taxa: *K. borealis* as its name implies is the northern outlier of this genus, its distribution is almost confined to the old Transvaal. *K. borealis* is the only species within the genus *Khadia* that has elongated branches and long internodes (Chesselet et al., 1998). Most members of this genus have a relatively restricted distribution occurring either in the Highveld or in Afromontane grasslands. The closest relation to *K. borealis* is *Khadia media* P. Winter & N. Hahn, endemic to a small area around Haenertsburg (Winter and Hahn, 1999).

Voucher: 2229 (Waterpoort): LaRoch (–DD), *Burgoyne 6130* (PRE), *Chesselet 144* (ZPB), *Hahn 430* (ZPB), *Hahn 604* (PRE, ZPB); 2230 (Messina): Mavhode (–CB), *Hahn 539* (ZPB), Studholme (–CC), *Burgoyne 6194* (PRE), *Sebothoma 371* (PRE); 2329 (Pietersburg): Lejuma (–AB), *Archer 2093* (PRE), *Van Jaarsveld 14234* (PRE).

4.1.3. Apocynaceae

4.1.3.1. Huernia nouhuysii. Verdoorn in Flowering Plants of South Africa 11: t. 412 (1931). Type: South Africa, Limpopo, 2229 (Waterpoort): Wylie's Poort (–DD), *Van Nouhuys s.n. PRE8757* (PRE, holo.?). Lectotype: Flowering Plants of South Africa 11: plate no. 412 (1931).

Distribution and habitat: *H. nouhuysii* is a rare succulent favouring the dry rocky regions of the western Soutpansberg central ridges, where it grows amongst rocks, grass and shrubbery, making it very difficult to locate.

Related taxa: *H. nouhuysii* is most closely related to *H. quinta* (Phillips) A.C. White & B. Sloane, occurring from Lephalale (previously Ellisras) east to Groblersdal with its main distribution being the Waterberg (Bruyns, 2005). *H. nouhuysii* can easily be separated from *H. quinta* by its shorter mottled corolla lobes.

Voucher: 2229 (Waterpoort): Clydesdale (–DD), *N. Hahn 611* (ZPB), Wyllie's Poort (–DD), *Van Nouhuys PRE 8757* (PRE).

4.1.3.2. Stapelia clavicorona. Verdoorn in Flowering Plants of Southern Africa 11: plate 407 (1931). Type: South Africa, Limpopo, 2229 (Waterpoort): Wyllie's Poort, near cement causeway drift in central gorge (–DD), *Van Nouhuys s.n. PRE8756* (PRE!).

Distribution and habitat: *S. clavicorona* is a rare succulent favouring the arid rocky regions of the western and central Soutpansberg.

Related taxa: *S. clavicorona* presents an unsolved enigma having no known relatives within the genus. White and Sloane (1937) place this species under their section Clavirostres, stating the following common features for the four species within this section, corolla has no annulus and the inner corona lobes are formed of two clavate horns. Leach (1985) in his revision of the genus *Stapelia* abandoned all subgeneric classification. He states that *S. clavicorona* conforms in most of its characteristics to the generic circumscription of *Stapelia* but is not closely related to any other species within the genus. Leach (1985) goes on to mention that the clavate inner corona-lobes are reminiscent of *Tromotriche herrei* (Nel) Bruyns, a Richtersveld endemic which is supported by Bruyns (2005).

Voucher: 2229 (Waterpoort): Devil's Gulley (–DD), *Hahn 1126* (ZPB), Wyllie's Poort (–DD), *Codd 54* (PRE), *Hardy 5422* (PRE), *Leach 5591* (PRE), *Malan, PRE 50813* (PRE), *Obermeyer, Schweickerdt & Verdoorn 414* (PRE), *Van Nouhuys PRE 8756* (PRE); 2230 (Messina): Aeriel (–CA), *Hahn 1114* (ZPB).

4.1.4. Asphodelaceae

4.1.4.1. Aloe petrophila. Pillans in South African Gardening & Country Life 23: 213 (1933). Type: South Africa, Limpopo, 2229 (Waterpoort): Wylie's Poort, rock-cliffs (–DD), 1924, (cultivated, flowered May 1933), *Ross-Frames BOL20482* (BOL!).

Distribution and habitat: *A. petrophila* is known from a few isolated populations around Wylie's Poort. This species is associated with cliffs where it grows on rock ledges or in fissures.

Related taxa: Within the Soutpansberg most closely related to *Aloe hahnii* a much larger plant not associated with cliffs. Outside the Soutpansberg this species is related to *Aloe swynnertonii* Rendle, endemic to the Zimbabwean Eastern High Lands and *Aloe branddraaiensis* Groenewald, endemic to the Wolkberg.

Voucher: 2229 (Waterpoort): Little Leigh (–DD), *Hahn 117* (ZPB), Wyllie's Poort (–DD), *Hahn 1673* (ZPB), *Pole-Evans 2693* (PRE), *Reynolds 1378, 1862* (PRE), *Ross-Frames BOL20482* (BOL).

4.1.4.2. Aloe soutpansbergensis. Verdoorn in Flowering Plants of Africa 35: plate 1391 (1962). Type: South Africa, Limpopo, 2329 (Pietersburg): 36 miles [58 km] west of Louis Trichardt (–AB), 1942, *Crundall s.n. PRE27035* (=PRE 29005) (PRE, holo.!).

Distribution and habitat: *A. soutpansbergensis* is a little grass *Aloe* known from the western parts of the mountain where it grows abundantly in clumps amongst sedges and moss on slopes ranging from 45° to vertical at an altitude between 1400 and 1600 m. There seems to be a close association between its distribution, the steep southern cliffs and the mist belt. This mesophytic species seems to be dependent on mist and is associated with spongy vegetation from which it can derive moisture. The western limit of *Aloe vossii* is the eastern limit of *A. soutpansbergensis*.

Related taxa: *A. soutpansbergensis* is related to *Aloe challisii* Van Jaarsv. & A.E.Van Wyk and *Aloe nubigena* Groenew both Wolkberg endemic species (Van Jaarsveld, 2011). *A nubigena* is a larger plant than *A. soutpansbergensis*, with slight to no dentition on its leaves. *A. challisii* has subterete glaucescent leaves whereas those of *A. soutpansbergensis* are flat and green.

Voucher: 2329 (Pietersburg): (–AB), *Crundall s.n. in PRE 27035* (=PRE 29005) (PRE); Lejuma (–AB), *Hardy 900* (PRE), *Meeuse 10345* (PRE), Happy Rest (–BB), *Hahn 1088* (ZPB).

4.1.4.3. Aloe vogtsii. Reynolds in Journal of South African Botany 2: 11 (1936). Type: South Africa, Limpopo, 2229 (Waterpoort): Franzhoek [Clydesdale], 10 miles [16 km] north-east of Louis Trichardt,

(cultivated Johannesburg, flowered 22 Mar 1936), *Vogts* sub. *Reynolds 1488* (PRE, holo.!).

Distribution and Habitat: *A. vogtsii* occurs on sandy quartzitic soils in grassland and amongst bushes in the central mist-belt regions of the Soutpansberg.

Related taxa: Morphologically most similar to *Aloe lateritia* Engler occurring in Tanzania, Kenya, Uganda, Rwanda and the Congo (Reynolds, 1966).

Voucher: 2229 (Waterpoort): Zwarthoek (–DD), *Hahn 86* (UNIN, ZPB), Clydesdale (–DD), *Vogts sub. Reynolds 1488* (PRE); 2230 (Messina): Entabeni State Forest (–CD), *Hahn 1519* (ZPB).

4.1.4.4. A. vossii. Reynolds in Journal of South African Botany 2: 65 (1936). Type: South Africa, Limpopo, Schyffontein (–DD), 5 miles [8 km] north of Louis Trichardt, (cultivated Johannesburg, flowered Mar 1934), *Voss in Reynolds 557* (PRE, holo.!; BOL).

Distribution and habitat: *A. vossii* occurs along the southern central to eastern ridges of the Soutpansberg, growing in grassland and amongst shrubbery on the high mountain plateau.

Related taxa: *A. vossii* is related to *Aloe verecunda* Pole Evans, occurring in two disjunct populations, one around Haenertsburg and the other occurring in Gauteng. *A. vossii* is separated from *A. verecunda* by its green leaves and orange flowers opposed to dull green leaves and red flowers.

Voucher: 2229 (Waterpoort): Hanglip (–DD), *Hahn 338* (ZPB), Clydesdale (–DD), *Hahn 1086* (ZPB), Schyffontein (–DD), *Voss in Reynolds 557* (PRE).

4.1.5. Asteraceae

4.1.5.1. Cineraria erodioides DC. var. *tomentosa*. Cron in Kew Bulletin 61: 449–535. Type: South Africa: Limpopo, 2230 (Messina): Gogogo (–CD), 1 Jul 2000, *Cron & Goodman 574* (J holo.!; E, K, MO, PRE!, S, iso.).

Distribution and habitat: *C. erodioides* var. *tomentosa* is endemic to the high rainfall regions of the eastern Soutpansberg growing amongst shrubbery in rocky areas.

Related taxa: *C. erodioides* var. *tomentosa* is related to *C. erodioides* DC. var. *erodioides* a widely distributed species occurring from the Eastern Cape north to the Wolkberg (Cron et al., 2006). *C. erodioides* var. *tomentosa* is separated from var. *erodioides* by white to grey tomentose leaf underside, opposed to sparingly hairy to glabrescent.

Voucher: 2230 (Messina): Gogogo (–CD), *Cron & Goodman 574* (J, E, K, MO, PRE, S), *Hahn 1678* (ZPB), *Van Wyk & Theron 4688* (PRE, PRU).

4.1.6. Combretaceae

4.1.6.1. Combretum vendae Van Wyk var. *vendae*. Van Wyk in South African Journal of Botany 3(2): 125–134 (1984). Type: South Africa, Limpopo, 2230 (Messina): Tengwe, Vuvha (–DA), 11 Apr 1980, *Van Wyk 3913* (PRU, holo.!; K, P, PRE!, iso.).

Distribution and habitat: *C. vendae* var. *vendae* is confined to slightly higher moisture areas than *C. vendae* var. *glabrata* N. Hahn, occurring in both the central and eastern parts of the Soutpansberg. *C. vendae* var. *vendae* grows on rocky and sandy areas associated with mountain bush clumps.

Related taxa: *C. vendae* var. *vendae* is most closely related to *C. vendae* var. *glabrata* and has in places been found growing sympatrically (Hahn, 2012). *C. vendae* can easily be separated from other *Combretum* species in the study area by its waxy upper leaf surface and prominently raised tertiary veining below. *C. vendae* var. *vendae* is separated from var. *glabrata* by its leaf underside being densely hairy to tomentose.

Voucher specimens: 2229 (Waterpoort): Little Leigh (–DD), *Hahn 30* (PRU, ZPB), Zwarthoek (–DD), *Hahn 106* (PRU, ZPB); 2230 (Messina): Gombani (–CB), *Hahn 630* (ZPB), Fefe (–CB), *Van Wyk 5667* (BM, PRE, PRU), Ha-Mabila (–CB), *Van Wyk 5676* (K, P, PRE, PRU), *Van Wyk 5677* (K, P, PRE, PRU), *Van Wyk, 5946* (PRE), *Van Wyk 5948* (PRE), *Van Wyk 5676* (PRE), Ha Mabila (–CD), *Mugedi 1465* (PRE), Muledzhi (–DA), *Van Wyk 3913* (PRU), *Van Wyk 5573* (PRE), *Van Wyk* 5574 (PRE), *Van Wyk 5575* (PRE), *Van Wyk 5582* (PRE), *Van Wyk 5585* (PRE), Sambandou (–DA), *Hahn 583* (ZPB), Savhani (–DA), *Van Wyk 5652* (PRE), Tsharokho (–DA), *Carr 200* (PRE, PRU), *Van Wyk 5640* (PRE, PRU), *Van Wyk 5641* (PRE), 5643 (PRE); Vuvha (–DA), *Van Wyk 4923* (PRE), *Van Wyk & Theron 4924* (PRE), *Van Wyk & Theron 4928* (PRE).

4.1.7. Convolvulaceae

4.1.7.1. Ipomoea bisavium. A. Meeuse in Bothalia 7(1): 26–27 (1958). Type: South Africa, Limpopo, 2229 (Waterpoort): Soutpansberg, 2 miles [3.2 km] south of Wylie's Poort (new road) [Wallace Dale] (–DD), 02 Apr 1957, *Meeuse 10181* (PRE, holo.!; K, iso.).

Distribution and habitat: *I. bisavium* presently only known from a few localities within the greater Wyllie's Poort area, growing amongst shrubbery on rocky slopes.

Related taxa: Meeuse (1958) pointed out that *I. bisavium* has its closest affinity to the tropical species of the genus.

Voucher: 2229 (Waterpoort): Wallace Dale (–DD), *Hahn 1498* (ZPB), *Meeuse 10181* (PRE, holotype), *Meeuse 10237* (PRE), Wylie's Poort (–DD), *Hahn 1720* (ZPB).

4.1.8. Crassulaceae

4.1.8.1. Cotyledon barbeyi Schweinf. ex Baker var. *soutpansbergensis*. Van Jaarsveld & A.E. Van Wyk in Aloe 49(1): 18 (2012). Type: South Africa, Limpopo 2229 (Waterpoort): Wyllie's Poort (–DD), on cliffs just at tunnel, Jun 2003 (cultivated Kirstenbosch, flowered 16 Apr 2010), *Van Jaarsveld & Xaba 18035* (PRE, holo.!).

Distribution and habitat: *C. barbeyi* var. *soutpansbergensis* is presently only known form from Wyllie's Poort, growing on west facing cliffs, ledges and within crevices.

Related taxa: *C. barbeyi* var. *soutpansbergensis* is most closely related to the widespread succulent shrub *C. barbeyi* var. *barbeyi* commonly found in the higher regions of the Soutpansberg and Blouberg. *C. barbeyi* var. *soutpansbergensis* can be differentiated from var. *barbeyi* by its smaller stature, grey-white colour of oblanceolate leaves and ascending and spreading inflorescence (Van Jaarsveld and Van Wyk, 2012).

Voucher: 2229 (Waterpoort): Wyllie's Poort (–DD), *Hahn 1674* (ZPB), *Van Jaarsveld & Xaba 18035* (PRE, holo.!).

4.1.8.2. Kalanchoe crundallii. Verdoorn in Flowering Plants of Africa 25: plate 967 (1946). Type: South Africa, Limpopo, 2329 (Pietersburg): at mountain Lejuma (–AB), Jul 1938, (cultivated Pretoria, flowered Mar 1943), *Crundall PRE27157* (PRE, holo.!).

Distribution and habitat: *K. crundallii* is a succulent found in association with the high-lying mist-belt regions of the western Soutpansberg occurring in the shade of woodlands.

Related taxa: Within the Soutpansberg the genus *Kalanchoe* is represented by seven taxa out of the 13 recorded for southern Africa, all of which are relatively widespread except for *K. crundallii*. In growth form *K. crundallii* closely resembles *Kalanchoe sexangularis* N.E.Br. especially when the latter grows in shade. In flower *K. crundallii*, can be separated from *K. sexangularis* by its red as opposed to yellow flowers.

Voucher: 2329 (Pietersburg): Lejuma (–AB), *Crundall PRE 27157* (PRE), *Hahn 1481* (ZPB); Rudyard (–BB), *Hahn 2030* (ZPB).

4.1.9. Fabaceae

4.1.9.1. Rhynchosia vendae. C.H. Stirton in Bothalia 14(1): 76 (1982). Type: South Africa, Limpopo, 2231 (Pafuri): Kruger National Park,

Punda Maria (–CA), 1700 ft. [518 m], 17 Feb 1954, *der Schijff 3596* (PRE, holo.!; K iso.).

Distribution and habitat: *R. vendae* is known from the tropical eastern savannah regions of the Soutpansberg.

Related taxa: At present *R. vendae's* association within the genus is unknown (Stirton, 1982).

Voucher: 2230 (Messina): Matatani (–DA), *Pienaar 1112* (PRE), Vuvha (–DA), *Van Wyk 4014* (PRE), Mhingas (–DB), *Hahn 1741* (ZPB), 7 miles NW of Punda Maria (–DB), Co*dd 6533* (PRE), 22 miles [35 km] north of Sibasa (–DC), *Codd 6897* (PRE); 2231 (Pafuri): Punda Maria (–CA), *Van der Schijff 3596* (PRE).

4.1.9.2. Senegalia montis-salinarum. N. Hahn in Phytotaxa 244(2): 175 (2016). Type: South Africa. Limpopo, 2229 (Waterpoort): Tanga (–DD), 770 m, 27 Mar 1992, *Hahn 351* (PRU holo.!; ZPB!, iso.).

Distribution and habitat: *S. montis-salinarum* is known from only two localities growing on rocky screes along the arid northern slopes of the eastern Soutpansberg.

Related taxa: *S. montis-salinarum* is most similar in general morphology to *Senegalia burkei* (Benth.) Kyal. & Boatwr (Hahn, 2016). *S. montis-salinarum* is a multi-stemmed tree growing on mountain scree slopes whereas *S. burkei* is a single-stemmed savannah tree.

Voucher: 2229 (Waterpoort): Tanga (–DD), *Hahn 351* (PRU, ZPB), *Hahn 2150* (ZPB).

4.1.10. Gesneriaceae

4.1.10.1. Streptocarpus parviflorus Hook. f. subsp. *soutpansbergensis*. Weigend & T. J. Edwards in Sendtnera 2: 369 (1994). Type: South Africa, Limpopo, 2229 (Waterpoort): 12 km from Mountain Inn to Bluegumspoort [Holworth] (–DD), 7 Feb 1982, *Stirton 10572* (PRE, holo.!).

Distribution and habitat: *S. parviflorus* subsp. *soutpansbergensis* is endemic to the high southern central regions of the Soutpansberg occurring in Afromontane forests.

Related taxa: *S. parviflorus* subsp. *soutpansbergensis* is related to the allopatric *S. parviflorus* subsp. *parviflorus* a Soutpansberg–Wolkberg protoparaendemic. *S. parviflorus* subsp. *soutpansbergensis* can be distinguished from subsp. *soutpansbergensis* by its light pink flowers having a distinct spreading limb marked with bold and occasionally forked lines (Weigend and Edwards, 1994).

Voucher: 2229 (Waterpoort): Hanglip (–DD), *Hilliard 4757* (NU), Holworth (–DD), *Stirton 10572* (PRE); 2330 (Tzaneen), Piesanghoek (–AA), *Gerstner 5722* (PRE).

4.1.11. Orchidaceae

4.1.11.1. Mystacidium braybonae. Summerhayes in Kew Bulletin 1949: 442 (1949). Type: South Africa, Limpopo, 2329 (Pietersburg): near Louis Trichardt (–BB), 1350 m, Nov 1948, (cultivated Kew), *Braybon* (K, image!).

Distribution and habitat: *M. braybonae* is an epiphytic orchid associated with the high altitude mist belt vegetation of the Soutpansberg, preferring shady places which are exposed to mist. This species is found across the Soutpansberg occurring in Afromontane forest and in other woody mountain vegetation. It is occasionally also lithophytic.

Related taxa: Two species of *Mystacidium* are known to occur on the Soutpansberg namely *Mystacidium venosum* Harv. ex Rolfe, a widely distributed plant in South Africa and *M. braybonae*. Within the Soutpansberg *M. venosum* grows allopatrically from *M. braybonae*, flowering in April to July whereas *M. braybonae* flowers mainly in December. *M. braybonae* can be distinguished from *M. venosum* by its densely crowded inflorescent with a spur 18–25 mm long as opposed to an evenly spaced lax inflorescence with a spur 20–45 mm long (McMurtry et al., 2008).

Voucher: 2229 (Waterpoort): Hanglip (–DD), *Van Wyk 5901* (PRE), Holworth (–DD), *Hahn 431* (ZPB); New Gate (–DD), *Hahn 636* (ZPB), Zwarthoek (–DD), *Hahn 399* (ZPB); 2230 (Messina): Mavhode (–CB), *Hahn 629* (ZPB); Venda, Thathe-Vondo (–CD), *Hahn 437* (ZPB), Fig Tree (–DD), *Hahn 620* (ZPB).

4.1.12. Pedaliaceae

4.1.12.1. Ceratotheca saxicola. E.A. Bruce in Bothalia 5(1): 233 (1951). Type: South Africa, Limpopo, 2231 (Pafuri): Kruger National Park, 31 miles [51.5 km] north-east of Punda Maria, 1000 ft. [305 m], in sandstone krantze overlooking the Luvuvhu River (–AC), 17 May 1949, *Codd & de Winter 5535* (PRE, holo.!; K, LMA, iso.).

Distribution and habitat: *C. saxicola* is found growing in rocky areas and cliffs mostly associated with *Androstachys johnsonii* woodlands and is endemic to the far north-eastern section of the Soutpansberg.

Related taxa: Two species of *Ceratotheca* are recorded for the Soutpansberg namely *Ceratotheca triloba* (Bernh.) E. Mey. ex Bernh., an eurytopic weed and *C. saxicola*, a stenotopic endemic to the north-eastern sector of the Soutpansberg. Bruce (1951) states that *C. saxicola* has its affinity to the tropical species of the genus.

Voucher: 2230 (Messina): Klein Tshipise (–BC), *Van Wyk 3442* (PRE), *Van Wyk 3452* (PRE), Malonga (–BC), *Glen 1422* (PRE); Thondoni (–BD), *Hahn 2111* (ZPB), Tshikondeni (–BD), *Hahn 1159* (ZPB); 2231 (Pafuri): Kruger National Park (–AC), *Codd & de Winter 5535* (PRE), *Codd 5980* (PRE).

4.1.13. Rubiaceae

4.1.13.1. Pavetta tshikondeni. N. Hahn in Bothalia 29(1): 109 (1999). Type: South Africa, Limpopo, 2231 (Pafuri): Makhuya Park, Worlds View (–CA), 300 m, 27 Jan 1997, *Hahn 1367* (K, holo.!; PRE!, ZPB!, iso.).

Distribution and habitat: *P. tshikondeni* is only known from the extreme north-eastern section of the Soutpansberg growing on rocky hillsides and outcrops, mainly in association with *Androstachys* woodlands.

Related taxa: The eurytopic genus *Pavetta* is well represented within the Soutpansberg. *P. tshikondeni*'s nearest ally is *Pavetta gracillima* S. Moore, restricted to south-eastern Zimbabwe and adjacent areas in Moçambique occurring in woodland and in sand forest (Hahn, 1999). Within the confines of South African members of the genus *Pavetta*, *P. tshikondeni* is related to *Pavetta catophylla* Bremek.

Voucher: 2230 (Messina): Klein Tshipise (–BC), *Van Wyk 3606* (PRE, PRU), Masisi (–BD), *Burrows 6646* (PRE); 2231 (Pafuri): Kruger National Park (–AC), *Codd & de Winter 5538* (PRE), Makhuya Park, Worlds View (–CA), *Hahn s.n.* (K, ZPB), *Hahn 1367* (K, PRE, ZPB).

4.1.13.2. Vangueria soutpansbergensis. N. Hahn in Bothalia 27(1): 45 (1997). Type: South Africa, Limpopo, 2230 (Messina): Studholme (–CC), 1440 m, 28 Nov 1995, *Hahn 1112* (PRU, holo.!; K!, PRE!, ZPB!, iso.).

Distribution and habitat: *V. soutpansbergensis* grows in a variety of habitats ranging from mountain mist-belt to dry *Androstachys* woodland across the Soutpansberg. *V. soutpansbergensis* is fairly common usually occurring within mixed woodlands and on rocky slopes.

Related taxa: *V. soutpansbergensis* is most closely related to its sympatric counterpart *Vangueria parvifolium* Sond. and can be distinguished from it by its glabrous as opposed to tomentose leaves (Hahn, 1997).

Voucher: 2229 (Waterpoort): Schlesinger's sawmill (–DC), *Gerstner 5912* (K, PRE), Surprise (–DC), *Hahn 454* (ZPB), Uniondale (–DC), *Hahn 329* (PRU, ZPB); Clydesdale (–DD), *Hahn 613* (ZPB), Rushton (–DD), *Hahn 650* (ZPB), Zwarthoek (–DD), *Hahn 109* (PRU, ZPB); 2230 (Messina): Studholme (–AA), *Hahn 1112* (K, PRE, PRU, ZPB), *Hahn 1164* (K, PRU, ZPB); 2330 (Tzaneen), Piesanghoek (–AA), *Gerstner 5736* (PRE),

4.1.14. Zamiaceae

4.1.14.1. Encephalartos hirsutus. P.J. Hurter in South African Journal of Botany 62(1): 46 (1996). Type: South Africa, Limpopo, 2230 (Messina): 1000 m, 7 Jun 1994, *Hurter 94R/1* (PRE, holo.!).

Distribution and habitat: *E. hirsutus* is known from three disjunct populations. The western population is associated with steep cliffs. The eastern populations are associated with *Androstachys* woodland growing amongst steep east to south-east facing boulder strewn slopes.

Related taxa: *E. hirsutus* is a member of an ancient group of plants of which pockets of related species are found scattered throughout southern Africa (Hurter and Glen, 1996).

Voucher: 2229 (Waterpoort): *Hurter 94R/3* (PRE); 2230 (Messina): *de Winter 10034* (PRE), *Glen 3747* (PRE, UNIN, K, MO), *Hurter 94R/1* (PRE).

4.2. Blouberg endemics

4.2.1. Asparagaceae

4.2.1.1. Ledebouria caesiomontana. A.J. Hankey & N. Hahn in Bothalia 44 (1): 31 (2014). Type: South Africa, Limpopo, 2328 (Baltimore): Beauley (–BB), cliff ledges in forest, 1658 m, 24 Mar 2007, *Hankey 2129* (PRE, holo.!; NBG!, iso.!).

Distribution and habitat: *L. caesiomontana* is known from five collections on the Blouberg where it has been recorded from low deciduous forest and forest margins in shallow, moss-covered lithosols and rock crevices under the shade of woody vegetation (Hankey et al., 2014).

Related taxa: *L. caesiomontana* is most similar to *Ledebouria papillata* Venter, a widely distributed plant known from the Pietersburg plateau, Gauteng and Eastern Cape (Venter, 2008). *L. caesiomontana* lacks the characteristic basal ovary lobes of *L. papillata*; in addition it lacks the regular and longitudinal rows of papilla on the scalp and leaves.

Voucher: 2328 (Baltimore): Beauley (–BB), *Hankey. 2130* (PRE), *Hahn 444* (ZPB); 2329 (Pietersburg): Blouberg Nature Reserve (–AA), *Venter 13507* (PRE), Dantsig 3 (–AA), *Archer 503* (PRE).

4.2.2. Asteraceae

4.2.2.1. Cineraria cyanomontana. Cron in South African Journal of Botany 63(3): 400 (1997). Type: South Africa, Limpopo, 2328 (Baltimore): near summit of Blouberg Mountain (–BB), 1900 m, 7 Dec 1990, *Cron, Scholes, Scholes & Christie 55* (J holo.!; E, iso.).

Distribution and habitat: *C. cyanomontana* is confined to the southern mist belt slopes of the Blouberg, growing amongst rocks and overhangs at an altitude of 1700–2000 m (Cron et al., 2006).

Related taxa: *C. cyanomontana* is morphologically most closely related to *Cineraria aspera*, a widely dispersed species occurring from the Western Cape to Limpopo (Cron et al., 2006). *C. cyanomontana* can be differentiated from *C. aspera* by its leaf lobes and pinnules being entire opposed to dentate.

Voucher: (Blouberg): *Esterhuysen 21461* (PRE), *Esterhuysen 21520* (PRE), *Leemann 109* (PRE), *Van der Schijff 5386* (PRE); 2328 (Baltimore): Beauley (–BB), *Hahn 1575* (ZPB), *Kremer-Kohne 177* (PRE), near summit of Blouberg Mountain (–BB), *Cron, Scholes, Scholes & Christie 55* (J holo.!; E, iso.).

4.2.3. Gesneriaceae

4.2.3.1. Streptocarpus longiflorus. (Hilliard & B.L. Burtt) T.J. Edwards in Bothalia 22(2): 193 (1992). Type South Africa, Limpopo, Blaauwberg [Blouberg], 16 Dec 1964, (cultivated, R.B.G. Edinburgh, *Burtt 2918, ex hort.* Thompson), C. 4895 (E, holo.; NU! iso.). Basionym: *Streptocarpus caeruleus* subsp. *longiflorus* Hilliard & B.L. Burtt in *Streptocarpus*, an African plant study: 388 (1971). Type as above.

Distribution and habitat: *S. longiflorus* is recorded from the Blouberg growing in shady moist areas along rivulets and in forests above 1700 m.

Related taxa: *S. longiflorus* is most closely related to *S. caeruleus* Hilliard & B.L. Burtt (Edwards et al., 1992). On the Blouberg both species have been recorded growing sympatrically, which led to much confusion when the two taxa were first described by Hilliard and Burtt (1971) (see: *S. caeruleus*). *S. longiflorus* has a corolla of 38–47 mm long as opposed to 20–30 mm for *S. caeruleus*.

Voucher: (Blouberg): *Van der Schijff 5443* (PRE), *Schlieben & Strey 8513* (PRE); 2328 (Baltimore): near Trig Beacon (–BB), *Codd & Dyer 9056B* (PRE), The Grange (–BB), *Hahn 2461* (ZPB).

4.3. Makgabeng endemics

4.3.1. Gesneriaceae

4.3.1.1. Streptocarpus makabengensis. Hilliard in Edinburgh Journal of Botany 49(1): 75 (1992). Type: South Africa, Limpopo, 2328 (Baltimore): Makabene Berg [Makgabeng], collected 1961, *Thompson & McNeil*, (cultivated, R.B.G Edinburgh, C3864, from seed sent by *McNeil*) (E holo.).

Distribution and habitat: *S. makabengensis* is only known from a few locations from the Makgabeng where it grows under rocky ledges.

Related taxa: *S. makabengensis* is most closely related to *Streptocarpus rimicola* Story, a species endemic to the Waterberg (Hilliard, 1992). *S. makabengensis* can be separated from *S. rimicola* by its leaf underside being beetroot red in colour.

Voucher: 2328 (Baltimore): *Thompson & McNeil*, (cultivated, R.B.G Edinburgh, C3864, from seed sent by *McNeil*) (E), Mont Blanc (–BD), *B.A. Egan 133* (UNIN).

4.4. Soutpansberg–Blouberg protoparaendemic

4.4.1. Acanthaceae

4.4.1.1. Justicia montis-salinarum. A. Meeuse in Bothalia 7(2): 407 (1960). Type: South Africa, Limpopo, 2329 (Pietersburg): southern entrance of Sandrivierspoort (–BA), about 4 miles [6.4 km] north of main road bridge, 3 Apr 1957, *Meeuse 10213* (PRE, holo.!).

Distribution and habitat: *J. montis-salinarum* has been recorded from the arid regions of both Blouberg and the western Soutpansberg, occurring on exposed rocky slopes.

Related taxa: Meeuse (1960) places *J. montis-salinarum* in the section Calophoides, with *Justicia orchioides* L.f., *Justicia odora* Vahl, *Justicia phillipseae* Rendle and *Justicia lorteae* Rendle. *J. montis-salinarum* differs from the first two mentioned species by its smaller flowers and narrow leaves. It differs from the last two by its pubescent corolla and capsules.

Voucher: 2229 (Waterpoort): Zoutpan (–CD), *Obermeyer, Schweickerdt & Verdoorn 168* (PRE), *Schlieben 7421* (PRE); Van Collerspass (–DC), *Hahn 1116* (ZPB), *Van Wyk 5536* (PRE); 2328 (Baltimore): Glenferness (–BB), *Herman 1219* (PRE); 2329 (Pietersburg): Auf Der Haard (–AA), *Herman 1276* (PRE); Sandrivierspoort (–BA), *Meeuse 10213* (PRE); Wallfield (–DD), *Fourie 341* (PRE).

4.4.2. Apocynaceae

4.4.2.1. Huernia whitesloaneana. Nel in Cactus and Succulent Journal of the Cactus and Succulent Society of America 8(1): 9 (1936). Type: South Africa, Limpopo, Entabeni Forest Station, 4500 ft. [1370 m], Jun 1935, (cultivated, University of Stellenbosch, flowered Mar 1936) *Nel STE5720* (NBG).

Distribution and habitat: *H. whitesloaneana* grows in rock crevices and lithosol along the mist-belt regions of the Soutpansberg and Blouberg.

Related taxa: This species falls in the greater *Huernia longituba* N.E. Br. group, showing no close affinity to any species of this group. Leach (1988) classified the species in the series Pauciangulosa subseries Australis, comprising eight taxa with the main centre of distribution being Zimbabwe.

Voucher: Blouberg: *Codd & Dye 9144* (PRE); Soutpansberg: Entabeni, *Taylor 2514* (PRE); 2229 (Waterpoort): Clydesdale (–DD), *Hahn 612* (ZPB), Mountain Inn (–DD), *Plowes 2617* (PRE); 2230: Rietbok (–CB), *Venter 8869* (PRE), Fig Tree (–CC), *Hahn 619* (ZPB), Matshavhawe (–CC), *Nkuna 73* (PRE), Khakhu (–CD), *Van Wyk 4136* (PRE).

4.4.2.2. Orbeanthus conjunctus. (White & Sloane) Leach in Excelsa Taxonomic Series no. 1: 73 (1978). Type: South Africa, Limpopo, 2329 (Pietersburg): Mara (–AB), (Crundall Comm. Herre; clonotype cult. PRE), *Crundall* (PRE). Basionym: *Stultitia conjuncta* White & Sloane in Cactus and Succulent Journal of America 10: 69 (1938). Type: as above. Synonym: *Orbea conjuncta* (White & Sloane) Bruyns in Aloe 37: 74 (2001). Type: as above.

Distribution and habitat: *O. conjunctus* is a procumbent succulent usually growing in humus-rich soils in closed woodland, also amongst rocks and grass clumps at altitudes above 1400 m in the Blouberg and Soutpansberg. This is an elusive succulent being difficult to locate amongst fallen leaves, rotten debris and roots.

Related taxa: *O. conjunctus* is most closely related *Orbeanthus hardyi* (R.A. Dyer) Leach which occurs to the south of the Soutpansberg. It differs from *O. conjunctus* by its lime coloured flowers mottled with maroon dots; the corolla is fused for up to 6 mm and the lobes reflex completely.

Voucher: 2229 (Waterpoort): Morningsun (–DD), *Hahn 1111* (ZPB), Wyllie's Poort (–DD), *Hardy 901* (PRE), *Meeuse PRE 50869* (PRE), 2329 (Pietersburg): Mara (–AB), *Crundall* (PRE).

4.4.3. Asphodelaceae

4.4.3.1. Aloe angelica. Pole Evans in Flowering Plants of South Africa 14: plate 554 (1934). Type: South Africa, Limpopo Province, 2229 (Waterpoort): Wylie's Poort (–DD), 16 Jun 1932, *Pole Evans PRE13040* (PRE, holo.!).

Distribution and habitat: *A. angelica* has been recorded from the drier regions of both the Blouberg and Soutpansberg forming very large communities. On the Soutpansberg the species has been recorded from the western extremities of the mountain, east up to the Kruger National Park. The plant grows in soils derived from quartzite, along boulder strewn slopes and in rock fissures.

Related taxa: Reynolds (1950) placed *A. angelica* in a separate group within the section Pachydendron as the species is taxonomically distinct, not closely related to any other *Aloe*. Morphologically *A. angelica* is similar in structure to *Aloe thraskii* Bak. occurring on the coastal dunes of Transkei and KwaZulu-Natal, and *Aloe pluridens* Haw from the eastern Cape to KwaZulu Natal but differs significantly in flower structure.

Voucher: Kruger National Park: Shidzivani; 2231DB or 2231CA, *Van der Schijff 3823* (PRE); 2229 (Waterpoort): Morningsun (–DD), *Hahn 530* (ZPB), Wylie's Poort (–DD), *Pole Evans s.n. sub PRE 13040* (PRE).

4.4.3.2. A. hahnii. G.F. Smith & R.R. Klopper in Bothalia 39(1): 98 (2009). Type: South Africa, Limpopo, 2230 (Messina): Lejuma, due east of Lejuma peak, (–AB), 08 Jun 2007, *Hahn 2172* (PRE, holo.!).

Distribution and habitat: *A. hahnii* occurs in the mist belt regions of the Blouberg and most of the Soutpansberg. The altitude ranges from 1000 m in eastern Soutpansberg to 2050 m on the Blouberg. *A. hahnii* commonly grows on sandy soil derived from quartzite and is found in *Coleochloa setifera* dominated grassland up to the margins of forests. On the western Soutpansberg it sometimes grows in low closed woodland in full shade. In the central regions of the Soutpansberg *A. hahnii* occasionally grows sympatrically with *A. vogtsii*.

Related taxa: *A. hahnii* is most closely related to *A. swynnertonii* differing from the latter by its shorter bracts, pedicels and perianths as well as flowers that are a glossier scarlet-red and more decurved. *A. vogtsii*, can be separated from *A. hahnii* by having buds that are borne horizontally in more elongated not capitate racemes. See also *A. petrophila*.

Voucher: 2229 (Waterpoort): Beeston (–DD), *Rossouw 170* (PRE), Hanglip (–DD), *Galpin 9681* (PRE), *Rossouw 131* (PRE); 2230 (Messina): Dzanani (–CB), *Hahn 534* (PRE, ZPB), Tshamavhudzi (–CB), *Hahn 1517* (ZPB), Mohepu Resort and Khakhu (–CC), *Grace, Van Wyk, Nkuna & Mabatha 59* (PRE); Khaku (–CC), *Hahn 2173* (PRE), Lake Fundudzi (–CD), *Hardy & Van Graan 3687A&B* (PRE), *Reynolds 1873* (PRE), *Vogts & Galpin PRE21202* (PRE), Sibasa (–CD), *Reynolds 2501* (PRE), Thathe Vondo (–CD), *Hahn 2176* (PRE), *Hemm 119* (PRE), Van Wyk 5572 (PRE), Vhufuli (–CD), *Hahn 127* (PRE, ZPB); 2328 (Baltimore): Beauley (–BB), *Hahn 1573* (ZPB), Blaauwberg, (–BB), *Meeuse 10343* (PRE), *Van der Merwe 1362* (PRE), *Strey & Schlienben 8536* (PRE), Blouberg Nature Reserve (–BB), *Archer 535* (PRE); 2329 (Pietersburg): Lejuma (–AB), *Hahn 2168, 2169* (PRE); *Smith & Klopper 1* (PRE), Llewelly (–AB), *Venter 6174* (PRE).

4.4.4. Asteraceae

4.4.4.1. Berkheya radyeri. Rössler in Mitteilungen der Botanischen Staatssammlung München 3: 181 (1959). Type: South Africa, Limpopo, 2328 (Baltimore): Blaauwberg [Blouberg], at Trig Beacon (–BB), 6700 ft. [2042 m], 12 Jan 1955, *Codd & Dyer 9026* (K, holo.; M, PRE!, iso.)

Distribution and habitat: On the Blouberg *B. radyeri* grows in clumps of grass between rocks from 1890 m upwards. On the Soutpansberg *B. radyeri* has been recorded from Lejuma peak (1748 m) growing between rocks.

Related taxa: *B. radyeri* is said to be related to *Berkheya setifera* DC. a widely dispersed species (Rössler, 1959).

Voucher: 2328 (Baltimore): Blouberg (–BB), *Burrows & Burrows 5083* (PRE), *Codd & Dyer 9026* (K, MO, PRE), *Van der Schijff 5383* (PRE); The Glen (–BB), *Raimondo 266* (ZPB); 2329 (Pietersburg): Lejuma (–AB), *Kremer-Kohne 336* (PRE).

4.4.5. Euphorbiaceae

4.4.5.1. Euphorbia aeruginosa. Schweickerdt in Bulletin of Miscellaneous Information (Royal Botanic Gardens, Kew) 1935(4): 205 (1935). Type: South Africa, Limpopo, 2229 (Waterpoort): Zoutpan (–CD), slopes of the Zoutpansberg [Soutpansberg] at Zoutpan, 12 Apr 1934, *Schweickerdt & Verdoorn 688* (K, lecto.; PRE!, isolecto.).

Distribution and habitat: *E. aeruginosa* is a spiny succulent occurring from the Blouberg and east across to the Kruger National Park. It is mostly confined to the drier northern sectors of both mountain ranges, growing amongst rocky outcrops.

Related taxa: *E. aeruginosa* belongs to the *Euphorbia schinzii* Pax complex differing from it by being more cylindrically branched and having blueish green branches and reddish spines. Within the study area *E. aeruginosa* is most closely related to *Euphorbia limpopoana* L.C. Leach ex S. Carter which is usually a much larger and robust plant with greyish thorns. Plants from the western Soutpansberg and Blouberg conform to the typical. On the farm Davenham, (*Hahn 261*) a long stemmed form was found and at Maangani (*Hahn 203*) a community was found which shows characteristics akin to *E. limpopoana*. Plants from the far north eastern Soutpansberg comprise a tangled mass of prostrate thorny braches forming a mat within *Androstachys* woodland (*Hahn 2180*).

Voucher: 2229 (Waterpoort): Zoutpan (–CD), *Obermeyer, Schweickerdt & Verdoorn 151* (PRE), *Schweickerdt & Verdoorn 688* (PRE); Morningsun (–DD), *Hahn 194* (ZPB); Davenham (–DD), *Hahn 261* (ZPB); 2230 (Messina), Maangani (–CC), *Hahn 203* (ZPB); 2231 (Pafuri): Makuya Nature Reserve (–AC), *Hahn 2180* (ZPB).

4.4.5.2. Euphorbia zoutpansbergensis. R.A. Dyer in Flowering Plants of South Africa plate 18: 715 (1938). Type: South Africa, Limpopo, 2229 (Waterpoort): on steep rocky slope, on left of road just before entering Wylie's Poort proper (–DD), Sep 1937, *Dyer 3873 sub PRE23393* (PRE, holo.!; E, K, MO, US, iso.).

Distribution and habitat: *E. zoutpansbergensis* occurs from the Blouberg in the west up to Nwanedi in the eastern Soutpansberg. *E. zoutpansbergensis* grows in a variety of habitats from the drier mist-belt region up to the arid central, north-facing slopes. It is associated with rocky areas growing on cliffs and talus in shallow humus-rich, sandy soils derived from quartzite.

Related taxa: In growth form *E. zoutpansbergensis* most closely resembles *Euphorbia sekukuniensis* R.A. Dyer a Sekhukhuneland endemic. None the less *E. zoutpansbergensis* differs significantly in flowering structures with cymes consisting of three vertically disposed cyathia opposed to those of *E. sekukuniensis* which are horizontally orientated (White et al., 1941).

Voucher: 2229 (Waterpoort): Surprise (–DC), *Hahn 1518* (ZPB); Wylie's Poort (–DD), *Dyer 3873 PRE sub 23393* (PRE), *Van der Merwe PRE sub 23394* (PRE).

4.4.6. Combretaceae

4.4.6.1. C. vendae Van Wyk var. *glabrata*. N. Hahn in South African Journal of Botany 78: 148 (2012). Type: South Africa, Limpopo, 2229 (Waterpoort): Bluebell (–CD), 1100 m, 29 Apr 1991, *Hahn 122* (PRU holo.!; ZPB iso.!).

Distribution and habitat: *C. vendae* var. *glabrata* occurs from the Blouberg throughout the western Soutpansberg up to the drier eastern areas of the mountain. Variant *glabrata* seems to favour slightly drier areas than the typical, occurring in savannah vegetation and on rocky slopes.

Related taxa: *C. vendae* var. *glabrata* is most closely related *C. vendae* var. *vendae*, it can be differentiated from the typical variety by its lower leaf surface being glabrous or occasionally sparsely hairy along the net-veining, whereas, var. *vendae* has a tomentose lower leaf surface. Beyond the Soutpansberg and Blouberg *C. vendae* var. *glabrata* is most closely related to *Combretum nelsonii* Dümmer, which occurs on the Makgabeng, Waterberg and Wolkberg. *C. vendae* var. *glabrata* is both morphologically alike and occupies similar ecological niches to *C. nelsonii*, leaves are more similar to those of *Combretum kraussii* than those of *C. vendae*. *C. nelsonii* leaves differ from those of *C. vendae* by not having marked raised tertiary veins, and its laminae are also thinner not being markedly leathery.

Voucher: 2229 (Waterpoort): Bluebell (–CD), *Hahn 316* (PRU, ZPB), Ingwe Motel (–DD), *Steyn 9* (PRE), Little Leigh (–DD), *Hahn 27* (PRU, ZPB), *Hahn 122* (PRU), 2230 (Messina): Gombani (–CB), *Hahn 631* (ZPB), Muledzhi (–DA), *Van Wyk 5579* (PRE; ZPB); 2328 (Baltimore): Beauley (–BB), *Hahn 2424* (PRU, ZPB); 2329 (Pietersburg): Glenferness (–AA), *Hahn 22* (PRU).

4.4.7. Crassulaceae

4.4.7.1. Crassula bloubergensis. R.A. Dyer in Botaniska Notiser 119: 213 (1966). Type: South Africa, Limpopo, 2328 (Pietersburg): Blouberg near Trig Beacon (–BB), 6700 ft. [2042 m], 12 Jan 1955, *Codd & Dyer 9036* (PRE, holo.!: K, iso.).

Habitat and distribution: *C. bloubergensis* has been recorded growing in shallow lithosol and rock cracks across both the Soutpansberg and Blouberg mist belt regions.

Related taxa: *C. bloubergensis* differs from *Crassula setulosa* Harv. var. *setulosa* having maroon-coloured leaves, bracts which are glabrous except for a few minute cilia on the margins, and its inflorescence being a few flowered cymes (Dyer, 1966). *C. bloubergensis* is most closely related to *C. setulosa* var. *jenkinsii* Schönland, a cremnophytic plant, recorded sporadically from its type locality at Krugersdorp north up to the Soutpansberg and Blouberg. *C. bloubergensis* differs from *C. setulosa* var. *jenkinsii* growing in shallow lithosol, having maroon-coloured leaves up to 14 × 3 mm and an erect inflorescence up to 60 mm tall as opposed to growing on steep slopes or cliffs with leaves green occasionally tinged red 10–30 × 6–14 mm and a pendulous inflorescence bending forward at the apex. *C. bloubergensis* is often found growing in the lithosol a few metres above steep slopes or cliffs where *C. setulosa* var. *jenkinsii* occurs. On the Soutpansberg *C. setulosa* var. *jenkinsii* has been found on the dry cliff faces up into the mist belt, whereas *C. bloubergensis* is restricted to the mist belt region.

Voucher: 2230 (Messina): Studholme (–CC), *Hahn 2313* (ZPB); 2328 (Pietersburg): Blouberg near Trig Beacon (–BB), *Codd & Dyer 9036* (PRE, K), The Grange (–BB), *Hahn 2456* (ZPB); 2329 (Pietersburg): Brinksrust (–AB), *Hahn 2157* (ZPB), Lejuma (–AC), *Linden 1* (ZPB).

4.4.8. Gesneriaceae

4.4.8.1. S. caeruleus. Hilliard & Burtt in *Streptocarpus*, an African plant study 387 (1971). Type: South Africa, Limpopo, Blouberg, (parent plant collected, 3 Dec. 1958, *Story 6512* (PRE), cultivated from seed R.B.G. Edinburgh), C. 3824 (E, holo.!; NU! iso.).

Distribution and habitat: *S. caeruleus* has been recorded from both the Blouberg and western Soutpansberg. *S. caeruleus* has been observed growing in a variety of habitats. In forests plants were found next to streams and waterfalls growing amongst moss and in humus rich soils. Plants also grow on sheltered vertical south facing cliffs amongst sedges and moss.

Related taxa: *S. caeruleus* is most closely related to *S. longiflorus* (Edwards et al., 1992). On the Blouberg both species have been recorded growing sympatrically which led to much confusion. Burtt (1962) suggested that the long and short-flowered plants of *S. longiflorus* and *S. caeruleus* may represent floral dimorphism. Hilliard and Burtt (1971) rejected this statement due to the intermediate flowers produced by F1 hybrids. To accommodate this genetic distinction Hilliard and Burtt (1971) placed the taxa together under *S. caeruleus* but distinguished the two as subspecies *S. caeruleus* subsp. *caeruleus* and *S. caeruleus* subsp. *longiflorus*. Edwards et al. (1992) raised the two taxa to specific level by virtue of their distinctive morphology, distributions which overlap, intermediate F1 hybrids and the occurrence of breeding barriers between these taxa.

Voucher: Blouberg: *Story 6512* (PRE); 2328 (Baltimore): near Trig Beacon, (–BB), *Codd & Dyer 9056* (PRE); The Grange (–BB), *Hahn 2462* (ZPB); 2329 (Pietersburg): Lejuma (–AB), *Hahn 1484* (ZPB); *Hilliard 4760* (NU), Tromp (–BB), *Hahn 1716* (ZPB).

4.4.9. Lamiaceae

4.4.9.1. Rabdosiella leemannii. N. Hahn in Bothalia 37(1): 37 (2007). Type: South Africa, Limpopo, 2329 (Pietersburg): Lejuma (–AB), 1638 m, 13 Apr 2005, *Hahn 2086* (ZPB, holo.!; PRE!, PRU!, iso.).

Distribution and habitat: *R. leemannii* is endemic to the Soutpansberg and Blouberg rocky Afromontane mist-belt and open bushland above 1400 m where it forms perennial shrubs up to 2 m tall.

Related taxa: *R. leemannii* is most closely related to the widespread grassland suffrutex *Rabdosiella calycina* (Benth.) Codd. *R. leemannii* is at once distinguished from *R. calycina* by its erect, shrubby nature, woody stems up to 50 mm in diameter, smaller leaves and flowers.

Voucher: 2229 (Waterpoort): Wellington (–DC), *Rossouw 208* (PRE). Hanglip (–DD), *Meeuse 10164* (PRE), Buckworth (–DD), *Meeuse 10243* (PRE); 2328 (Baltimore): Blouberg, alt. 6000 ft. [1968 m] (–BB), *Leemann 118* (PRE), Beauley (–BB), *Hahn 1574* (ZPB). The Grange (–BB), *Codd 8759* (PRE), *Hahn 2442* (ZPB), *Strey & Schlieben 8517* (PRE), (–BB), *Van der Schÿff 5416* (PRE); 2329 (Pietersburg): Lejuma (–AB), *Hahn* 2086 (ZPB), *Venter 7855* (PRE), *Venter 8754* (PRE).

4.4.10. Poaceae

4.4.10.1. Sartidia jucunda. (Schweickerdt) De Winter in Kirkia 3: 137 (1963). Type: South Africa: Limpopo, 2328 (Baltimore): Blaauwberg [Blouberg], summit of mountain near Malaboch's Kraal (–BB), 6700 ft. [2042 m], 8 Apr 1947, *Schweickerdt 1807* (PRE!, PRU!; IT: B, K, L, M, S, US). Basionym: *Aristida jucunda* Schweickerdt in Botanische Jahrbücher 76(2): 221 (1954). Type: as above.

Distribution and habitat: *S. jucunda* has been found growing on rocky outcrops and slopes at an altitude of 1100–2050 m on both the Blouberg and Soutpansberg.

Related taxa: *S. jucunda* is most similar to *Sartidia dewinteri* J. Munday & L. Fish, a Barberton Greenstone Belt endemic (Balkwill et al., 2011). *S. dewinteri* is associated with serpentiniferous Afromontane grassland mainly occupying hill slopes and rocky ridges.

Voucher: 2229 (Waterpoort): Wellington (–DC), *Rossouw 216* (PRE), Morningsun (–DD), *Hahn 2484* (PRE, PRU, ZPB); 2328 (Baltimore): Blouberg (–BB), *Schweickerdt 1807* (PRE!, PRU!; IT: B, K, L, M, S, US), Leipzig (–BB), *Codd 8686* (PRE), *Smook 7501* (PRE), *Strey & Schlieben 8502* (PRE), *Van der Schijff 5378* (PRE).

4.5. Soutpansberg–Blouberg–Makgabeng biparaendemics

4.5.1. Apocynaceae

4.5.1.1. Tylophora coddii. Bullock in Flowering Plants of Africa 36: plate 1435 (1964). Type: South Africa, Limpopo, 2229 (Waterpoort): south end of Wylie's Poort on dry rocky slopes (–DD), 3500 ft. [1050 m], 24 Jan 1954, *L. E. Codd 8350* (PRE, holo.!; K, iso.).

Distribution and habitat: *T. coddii* grows on exposed rock strata in fissures and shallow soil pockets from the arid regions of the three mountain ranges up into the mist-belt.

Related taxa: *T. coddii* is closely related to *Tylophora fleckii* (Schltr.) N.E. Br. occurring in desert regions of Namibia (Bruyns, 2014). *T. fleckii* is also said to occur in northern Kenya, northern Tanzania and Somalia (Goyder, 2006) which is most unlikely. *T. coddii* is similar in appearance to *T. fleckii* being glabrous throughout opposed to having pubescent stem and leaves. In addition, *T. fleckii* leaves are small not exceeding 15 mm in length.

Voucher: 2229 (Waterpoort): Bangor (–DC), *Venter 13123* (PRE), Crewe (–DC), *Bester & Willis* 3753 (PRE), Ladismit (–DC), *Hahn 1371* (ZPB), LaRoch (–DD), *Burgoyne 6131* (PRE), *Hahn 1389* (ZPB), Wylie's Poort (–DD), *Codd 8350* (PRE), *Meeuse10613* (PRE); 2230 (Messina): Nwanedzi Nature Reserve (–CB), *Hahn 2531* (PRU, ZPB), Studerholm (–CC), *Hahn 1129* (ZPB), *Hahn 1396* (ZPB), *Meyer 1263* (PRE); 2328 (Baltimore), Ga-Monnaasenamoriri (–BB), *Archer 526* (PRE), The Grange (–BB), *Bester 9380* (PRE), *Dyer & Codd 5450* (PRE), *Dyer & Codd 5700* (PRE); 2329 (Pietersburg), Lajuma (–AB), *Sachse 643* (PRE).

4.5.2. Asteraceae

4.5.2.1. Dicoma montana. Schweickerdt in Bulletin of Miscellaneous Information (Royal Botanic Gardens, Kew) 1935: 207 (1935). Type: South Africa, Limpopo, 2328 (Baltimore): Blouberg, on the way to Malabogs Kraal (–BB), 5000–5400 ft. [1524–1555 m], 9 May 1933, *Leemann 69* (PRE holo.!; K, iso.).

Distribution and habitat: *D. montana* has been observed growing on the Soutpansberg, Blouberg and Makgabeng in inclined to vertical bedrock fissures.

Related taxa: *D. montana* is related to *Dicoma galpinii* F.C. Wilson from Mpumalanga and Limpopo and *Dicoma nachtigalii* O. Hoffm. from the Northern Cape to Lüderitz in Namibia. *D. montana* is at once distinguished from its related taxa by its involucel bracts that are covered by a distinct indumentum resembling cobwebs.

Voucher: 2229 (Waterpoort): Surprise (–DC), *Fourie 184* (PRE), Rushton (–DD), *Raal, & Raal 341* (PRE); 2230 (Messina): Nwanedzi Nature Reserve (–CB), *Hahn 2531* (PRU, ZPB), *Van Wyk 3423* (PRE); 2231 (Pafuri): Luvuvhu Gorge (–AC), *Hahn s.n.* (ZPB); 2328 (Baltimore): Glenfurness (–BB), *Herman 1222* (PRE), Leipzig (–BB), *Venter 6169* (PRE), *Venter 6177* (PRE), Maloboch Stad (–BB), *Codd 8689* (PRE), *Codd & Dyer 9169* (PRE), *Van der Schijff 8486* (PRE); 2329 (Pietersburg): Bergplaats (–AB), *Hahn 3116* (ZPB).

4.5.2.2. Zoutpansbergia caerulea. Hutchinson in A Botanist in southern Africa 350 (1946). Type: South Africa, Limpopo, (2229DC or 2329BA?): Crewe, western Soutpansberg, northern slopes of mountains, 5200 ft. [1585 m], 23 Aug 1930, *Hutchinson & Gillett 4435* (K, holo.!). Synonym: *Callilepis caerulea* (Hutch.) Leins in Mitteilungen der Botanischen Staatssammlung München 9: 108 (1971). Type as above.

Distribution and habitat: In the western Soutpansberg *Z. caerulea* sporadically occurs in isolated patches whereas between Fefe and Mabile it occurs frequently and at places forms large populations. *Z. caerulea* has also been recorded growing on the Blouberg and Makgabeng.

Related taxa: *Zoutpansbergia* is a monotypic genus closely related to *Callilepis* DC.

Voucher: Soutpansberg (2229DC or 2329BA?): Crewe, *Hutchinson & Gillett 4435* (K); 2229 (Waterpoort): Crewe (–DC), *Bester & Willis 3752* (PRE), Ladysmit, (–DC), *Hahn 62* (PRU, ZPB), Davenham, (–DD), *Hahn 548* (ZPB); 2230 (Messina): between Mufulwi and Tshumulungwi (–CB), *Koekemoe 2259* (PRE), Mavhode (–CB), *Hahn 537* (ZPB) Khaku (–CC), *Hahn 1516* (PRE), Dzamba (–CD), *Van Wyk 5664* (PRE), Gogogo (–CD), *Van Wyk & Theron 4692* (PRE); 2328: Blaauwberg [Blouberg] (–BB), *Esterhuysen PRE 42800* (PRE), *Esterhuysen* 21460 (PRE), The Grange (–BB), *Codd 8757* (PRE); 2329 (Pietersburg): Lejuma (–AB), *Hahn 718* (ZPB), *Venter 10771* (PRE), Llewellyn (–AB), *Venter 6197* (PRE).

4.5.3. Anacardiaceae

4.5.3.1. Searsia magalismontana (Sond.) Moffett subsp. *coddii.* (R. & A. Fernandes) Moffett in Bothalia 37(2): 170 (2007). Type: South Africa, Limpopo, 2230 (Messina): near Sambondou (–DA), 25 miles [40 km] north-east of Sibasa, 1900 ft. [580 m], 20 Feb 1952, *Codd 6902* (PRE, holo.!). Basionym: *Rhus coddii* R. & A. Fernandes in Boletim da Sociedade Broteriana sér. 2(39): 251 (1965). Type as above. Synonym: *Rhus schliebenii* R. & A. Fernandes in Boletim da Sociedade Broteriana sér. 2 (39): 255, t. 11 (1965). Type: South Africa, Limpopo, 2329 (Pietersburg): 42 miles [67 km] west of Louis Trichardt (–AB), 1500 m, 3 Nov 1955, *Schlieben 7532* (PRE, holo.!). *Rhus magalismontana* Sond. subsp. *coddii* (R. & A. Fernandes) Moffett in Flora of southern Africa 19(3): 57 (1993). Type as for *S. magalismontana* subsp. *coddii*.

Distribution and habitat: *S. magalismontana* subsp. *coddii* has been observed growing on the Soutpansberg, Blouberg and Makgabeng where it occurs in a variety of habitats but always growing on soils derived from quartzite.

Related taxa: *S. magalismontana* subsp. *coddii* is related to *S. magalismontana* subsp. *magalismontana* that occurs in Gauteng, North West, extending to the Waterberg and a short distance into Botswana and *S. magalismontana* subsp. *trifoliolata* (Bak. f.) Moffett occurring on the Waterberg and in Zimbabwe near Bulawayo and Gwero.

Voucher: 2229 (Waterpoort): Bangor (–DC), *Krynauw 1414* (PRE), Wallfield (–DC), *Moffett 1941* (PRE), *Moffett 1942* (PRE), Kidsgrove (–DD), *Raal & Raal 723* (PRE), Little Leigh (–DD), *Hahn 70* (ZPB; PRU), Zwarthoek (–DD), *Balkwill, Balkwill & Cron 9095* (PRE); 2230 (Messina): Maname (–CD), *Van Wyk & Theron* 4753 (PRE), Tata Vondo (–CD), *Hemm 615* (PRE), *Moffett 1952* (PRE), Domboni (–DA), *Hahn 48* (ZPB; PRU), Gunda (–DA), *Nkuna 1* (PRE), Sambandou (–DA), *Codd 6902* (PRE), Tshamavhudzi (–DA), *Archer 438* (PRE), Van Wyk 3638 (PRE); Mphaphuli (–DC), Grobbelaar B255 (PRE); 2328 (Baltimore): Blouberg (–BB), *Van Jaarsveld 11413* (PRE), *Venter*

6184 (PRE), Too Late (–BD), *Hahn 2430* (ZPB); 2329 (Pietersburg): Lejuma (–AB), *de Winter 6009* (PRE), *Venter 7540* (PRE).

4.5.4. Poaceae

4.5.4.1. Panicum dewinteri. J.G. Anderson in Bothalia 9(2): 341 (1967). Type: South Africa, Limpopo, 2329 (Pietersburg): Lejuma (–AB), 14 Feb 1967, *de Winter 6006* (PRE, holo.!; K, M, NH, SRGH, iso.).

Distribution and habitat: *P. dewinteri* grows in various habitats mainly associated with rocky outcrops and crevices.

Related taxa: None known in southern Africa.

Voucher: 2229 (Waterpoort): Leshiba Wilderness (–DC), *Nkuna 2846* (PRE); Bosley (–DD), *Raal & Raal 377* (PRE), Closeburn (–DD), *Raal & Raal 546* (PRE), Parkfield (–DD), *Raal & Raal 444* (PRE), *Raal & Raal 556* (PRE), Rushton (–DD), *Raal & Raal 281* (PRE), Wyllie's Poort (–DD), *Codd 8366* (PRE); 2328 (Baltimore): Leipzig (–BB), *Smook 7500* (PRE), Normandy (–BB), *Boyd 62* (PRE); The Grange (–BB), *Codd 8766* (PRE), *Codd & Dyer 9080* (PRE), *Hahn & Winter 2472* (ZPB); 2329 (Pietersburg): Lejuma (–AB), *de Winter 6006* (PRE, holo.!; K, M, NH, SRGH, iso.).

4.6. Excluded species

4.6.1. Apocynaceae

4.6.1.1. Duvalia procumbens. R.A. Dyer in Flowering Plants of South Africa 31: plate 1218 (1956). Type: South Africa, Limpopo, 2231 (Pafuri), Kruger National Park, Pafuri, ridge near Seekoegaat, (cultivated, Pretoria, flowered 16 Feb 1955) *Van der Schiff 3618* (PRE, holo.!; K iso.). Synonyms: *Huernia procumbens* (R.A. Dyer) Leach in Bothalia 10(1): 54 (1969). Type: as above.

Distribution and Habitat: *D. procumbens* is known from the far north eastern section of the Soutpansberg and an adjacent locality in Zimbabwe just north of the Limpopo River (*Leach, H.H. Mockford & D. Mockford 12286A*). The plant was found growing on rocky slopes and ledges in association with *Androstachys* woodlands in shallow soils derived from Karoo Supergroup sediments.

Related taxa: Controversy exists as to the exact generic disposition of this species. Dyer (1971) considers this species to reside under the genus *Duvalia* Haw. while Leach (1969), Meve (1997) and Bruyns (2005) classify it under *Huernia*. This confusion arose due to Letty's incorrect illustration of the flowering structure of *D. procumbens* which resemble those of a *Huernia* (Hahn, 2002). *D. procumbens* is most closely allied to *Duvalia tanganyikensis* Bruce & Bally occurring in Northern Tanzania, a geographic disjunction of over 2000 km.

Exclusion: *D. procumbens* is at present seen as a Soutpansberg–Limpopo Valley protoparaendemic falling outside the scope of this article with the narrowly defined boundaries of the Soutpansberg.

Voucher: Zimbabwe 2231: Pesu River Gorge, *Leach, H.H. Mockford & D. Mockford 12286A* (PRE).

4.6.2. Asteraceae

4.6.2.1. Gymnanthemum triflorum. (Bremekamp) H. Robinson in Phytologia 87(2): 80 (2005). Type: South Africa, Limpopo 2328 (Baltimore): Leipzig (–BB), *Bremekamp & Schweickerdt 67* (PRE, holo.!; PRU!, iso.). Basionym: *Vernonia triflora* Bremekamp in Annals of the Transvaal Museum 15(2): 262. Type: as above. Synonym: *Gymnanthemum koekemoerae* H. Robinson & V.A. Funk in PhytoKeys 36: 61 (2014) *syn. nov*. Type. South Africa. Limpopo (Messina 2230): Thathe Vondo (–CD), grassland at rocky outcrop near entrance, 1233 m, 23 Mar 2002, *Koekemoer 2273* (PRE holo.!; US, iso.).

Distribution and Habitat: *G. triflorum* is a widely dispersed montane species having been recorded for the Blouberg, Waterberg, Wolkberg and Soutpansberg, *G. koekemoerae* (sensu Robinson & Funk) on other hand was thought to be endemic to Thathe Vondo in the eastern Soutpansberg.

Exclusion: *G. koekemoerae* was considered distinct from *G. triflorum* possessing five florets per capitula, with sparsely puberulous to essentially glabrous leaves opposed to three florets per capitula and hispid to tomentose leaves (Robinson and Funk, 2014). From a subsequent revision of Vernonieae it is apparent that the authors' concept of *G. koekemoerae* was based on the type specimen only and *G. triflorum* on, *Stalmans 325* from The Downs, Mpumalanga (Robinson et al., 2016). It is therefore apparent that authors had never seen the type specimen of *G. triflorum* nor have they seen any specimens for either the Soutpansberg or Blouberg to allow an informed interpretation of the taxonomic delineation of the taxa involved. From a live shrub at the type locality of *G. koekemoerae* 25 flowers were dissected having (4)5–6(7) florets per capitula (*Hahn 3110*). Two additional localities were visited to the west of the type locality with the following results: (2)3–4 (n25) (*Hahn 3113*) and (2)3–4(5) (n150) (*Hahn 3118*). In addition, all live and herbarium specimens examined from the Soutpansberg and Blouberg leaves were either sparsely puberulous to essentially glabrous. From the above it is clear that no distinction can be made between *G. triflorum* and *G. koekemoerae*.

Voucher: 2230 (Messina): Sterkstroom (–CC), *Hahn 3113* (ZPB), Thathe Vondo (–CD), *Hahn 3110* (ZPB); 2329 (Pietersburg): Bergplaats (–AB), *Hahn 3118* (PRE, ZPB).

4.6.3. Euphorbiaceae

4.6.3.1. Euphorbia rowlandii. R.A. Dyer in Bothalia 7(1): 28 (1958). Type: South Africa, Limpopo, Kruger National Park, hills 8 miles [13 km] north of Punda Maria, 1600 ft. [488 m], *Rowland Jones 48* (PRE, holo.!; K, SRGH, iso.).

Distribution and habitat: *E. rowlandii* is known from the far north eastern section of the Soutpansberg and an adjacent locality in Zimbabwe 23 km northwest of Pafuri (*Leach, H.H. Mockford & D. Mockford 12286*). *E. rowlandii* was observed growing on Karoo supergroup sandstone hills and rocky areas growing in either pure *Androstachys* woodland, in mixed *Androstachys–Colophospermum* woodlands or in adjacent *Colophospermum* woodland.

Related taxa: *E. rowlandii* is most closely related to *Euphorbia waterbergensis* R.A. Dyer (Dyer, 1958).

Exclusion: *E. rowlandii* is at present considered a Soutpansberg–Limpopo Valley protoparaendemic falling outside the scope of this article with narrowly defined boundaries of the Soutpansberg.

Voucher: Zimbabwe 2231: Pesu River Gorge, *Leach, H.H. Mockford & D. Mockford 12286* (PRE).

Table 1
Summary statistics of the endemic taxa of the Soutpansberg, Blouberg and Makgabeng. Sou = Soutpansberg, Blou = Blouberg, Mak = Makgabeng endemics; S–B = Soutpansberg–Blouberg protoparaendemics; S–B–M = Soutpansberg–Blouberg–Makgabeng biparaendemics.

	Sout	Blou	Mak	S–B	S–B–M	Total
Families	14	3	1	10	4	32
Genera	19	3	1	11	5	32
Taxa	22	3	1	13	5	44
Tree	4			3	2	9
Tree %	18.2	0.0	0.0	23.1	40.0	20.5
Succulent	11			7	1	19
Succulent %	50.0	0.0	0.0	53.8	20.0	43.2
Mist belt	11	3		8	5	27
Mist belt %	50.0	100.0	0.0	61.5	100.0	61.4
Mist belt only	9	3		6		18
Mist belt only %	40.9	100.0	0.0	46.2	0.0	40.9

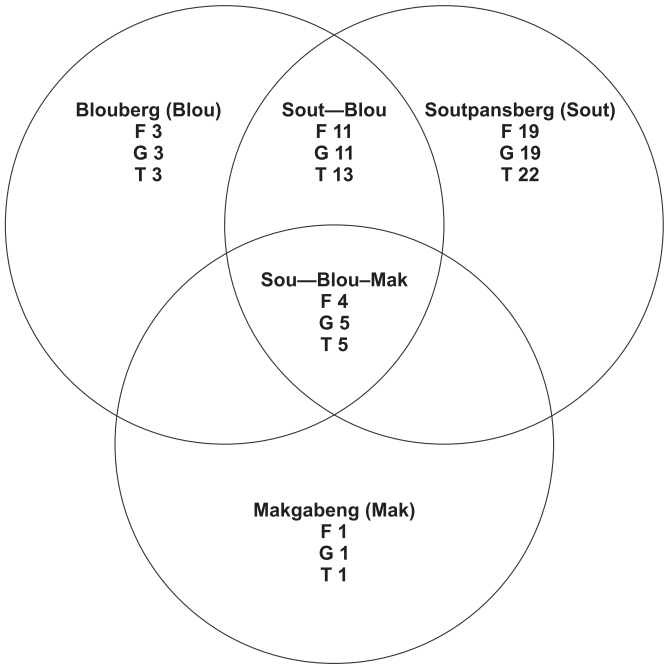

Fig. 3. Diagrammatic representation of the summary statistics of the endemic taxa of the Soutpansberg, Blouberg and Makgabeng. F = no. families, G = no. genera and T = no. taxa.

5. Discussion and conclusion

Forty four endemic taxa are recorded for the Soutpansberg, Blouberg and Makgabeng belonging to 32 families and 32 genera (Table 1 & Fig. 3). It is therefore clear that the endemic flora has not sprung up as a result of a single group diversifying into a multitude of forms. The endemic flora comprises nine (21%) trees and 19 (43%) succulent species (Table 2). 61% of the endemic species occur within the mist belt region and no fewer than 41% are restricted to it. In times of drought a large percentage of the high altitude mountain flora survives on precipitation resulting from the regular mist. Very little is known about mist and its interaction with the environment. At Entabeni in the eastern Soutpansberg mist precipitation has been measured at an average of 1366 mm per annum (Department of Environmental Affairs, 1988). Taking into account Entabeni's average annual rainfall of 1867 mm, the average total meteorological precipitation is 3233 mm per annum. Interestingly 10 (23%) species of succulents are restricted to the mist belt. Asphodelaceae is the most species rich family encompassing six taxa all belonging to the genus *Aloe*. Both Apocynaceae and Asteraceae contain four genera with five taxa. *Streptocarpus* is the only genus which has an endemic species restricted to each of the three mountains: *S. parviflorus* subsp. *soutpansbergensis* to the Soutpansberg, *S. longiflorus* to the Blouberg and *S. makabengensis* to the Makgabeng. No endemic annual plants have been recorded for any of the three mountains.

5.1. Soutpansberg endemics

The endemic flora of the Soutpansberg encompasses 22 taxa within 19 genera and 14 families. The genus *Aloe* is the most diverse endemic plant group with two grass aloes and two maculate aloes. *A. petrophila*, *A. soutpansbergensis* and *C. barbeyi* var. *soutpansbergensis* are cremnophytes. Four (18%) tree species and 11 (50%) succulent species are endemic to the Soutpansberg. Nine (41%) endemic species are restricted to the mist belt region of the mountain of which seven are succulent.

Table 2
Summary of the endemic taxa of the Soutpansberg, Blouberg and Makgabeng. Sout = Soutpansberg, Blou = Blouberg and Mak = Makgabeng endemics; Sout–Blou = Soutpansberg–Blouberg protoparaendemics; Sout–Blou–Mak = Soutpansberg–Blouberg–Makgabeng biparaendemics; Suc = succulent; MB = mist belt; MBo = mist belt only.

	Name	Tree	Suc	MB	MBo
Sout	*Aloe petrophila*		X		
	Aloe soutpansbergensis		X	X	X
	Aloe vogtsii		X	X	X
	Aloe vossii		X	X	X
	Blepharis spinipes				
	Ceratotheca saxicola				
	Cineraria erodioides var. *tomentosa*			X	X
	Combretum vendae var. *vendae*	X		X	
	Cotyledon barbeyi var. *soutpansbergensis*		X		
	Delosperma zoutpansbergense		X	X	X
	Encephalartos hirsutus	X			
	Huernia nouhuysii		X		
	Ipomoea bisavium				
	Kalanchoe crundallii		X	X	X
	Khadia borealis		X	X	X
	Mystacidium braybonae		X	X	X
	Pavetta tshikondeni				
	Rhynchosia vendae				
	Senegalia montis-salinarum	X			
	Stapelia clavicorona		X		
	Streptocarpus parviflorus subsp. *soutpansbergensis*			X	X
	Vangueria soutpansbergensis	X		X	
Blou	*Cineraria cyanomontana*			X	X
	Ledebouria caesiomontana			X	X
	Streptocarpus longiflorus			X	X
Mak	*Streptocarpus makabengensis*				
Sout–Blou	*Aloe angelica*	X	X		
	Aloe hahnii		X	X	X
	Berkheya radyeri			X	X
	Combretum vendae var. *glabrata*	X			
	Crassula bloubergensis		X	X	X
	Euphorbia aeruginosa		X		
	Euphorbia zoutpansbergensis	X	X		
	Huernia whitesloaneana		X	X	X
	Justicia montis-salinarum				
	Orbeanthus conjunctus		X	X	
	Rabdosiella leemannii			X	X
	Sartidia jucunda			X	
	Streptocarpus caeruleus			X	X
Sout–Blou–Mak	*Dicoma montana*			X	
	Panicum dewinteri			X	
	Searsia magalismontana subsp. *coddii*	X		X	
	Tylophora coddii		X	X	
	Zoutpansbergia caerulea	X		X	

5.2. Blouberg endemics

The endemic flora of the Blouberg encompasses three taxa within three genera and three families. All three Blouberg endemic species are restricted to mist belt habitat above 1600 m. *L. caesiomontana* is the only endemic bulb species recorded across the three mountains.

5.3. Makgabeng endemic

S. makabengensis is the only endemic species recorded for the Makgabeng. Very little is known about this plant and its habitat with only a few communities known. There is an urgent need to investigate the Makgabeng flora thoroughly and this may yield additional endemic species.

5.4. Soutpansberg–Blouberg protoparaendemics

The Soutpansberg–Blouberg protoparaendemics comprise 13 taxa, within 11 genera and 10 families. Three (23%) tree species and seven

(54%) succulent species are endemic to the Soutpansberg and Blouberg. Six (46%) endemic species are restricted to the mist belt region of the mountains of which three are succulent.

5.5. Soutpansberg–Blouberg–Makgabeng biparaendemics

The Makgabeng does not support a very high biodiversity, nonetheless it has one known endemic and a strong link to the Soutpansberg and Blouberg flora. The Soutpansberg–Blouberg–Makgabeng biparaendemics comprise five taxa, within five genera and four families. Two (40%) tree species and one (20%) succulent species are endemic to the Soutpansberg, Blouberg and Makgabeng. None of the endemic species are restricted to the mist belt region of these mountains.

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